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Dear Mr. Harrigan:

Thank you for the opportunity to review the Chino Mines Administrative Order on Consent Site (AOC)-Wide Ecological Risk Assessment (SWES; November 2005) and the subsequent "Chino Mines Administrative Order on Consent Ecological Risk Assessment for the Smelter Tailings Soil Investigation Unit (SWES-STIU; July 2007). Both the SWES and SWES-STIU characterize risk to vegetation and terrestrial wildlife, and aquatic organisms where water is present. Taken together, these documents reflect a tremendous effort and go into great detail documenting, reporting, and interpreting a large collection of physical, chemical and biological data related to the ecological health of the Chino Mine AOC area. However, because of the documents length and complexity, it is difficult to thoroughly touch on all the issues of concern to the U.S. Fish and Wildlife Service (Service); while we have attempted to address major issues, please do not interpret a lack of comment on a particular sentence or portion of the document as implicit agreement. We are concerned that the document text appears to downplay ecological risks, and is inconsistent with the data.

Vegetation Risk Analysis (SWES Section 2)

Determining effects of smelter and tailings releases on vegetation in the Chino AOC assessment area is complex, because vegetation characteristics are a function of the combined influence of numerous factors, such as grazing, soil types, elevation, precipitation runoff, metals, and soil pH. Based on the combined data related to cupric ion availability to plants, laboratory toxicity testing, and field observations of vegetation characteristics, plant communities in and around the smelter/tailings investigation unit have been adversely affected.

Effects to plants within ephemeral drainages and communities at the northernmost boundary of current sampling efforts are less certain. Current sampling indicates that these areas are acidic and contaminated with copper, so that adverse effects to vegetation are likely. However, because there are no vegetation reference sites applicable to these habitats (ephemeral drainages and higher elevations), effects to vegetation characteristics (e.g., cover, diversity) can not be conclusively evaluated in ephemeral drainages. Current reference sites are only applicable to upland sites at similar elevations.

Although not directly assessed, one can infer from these results and the associated soil chemistry that soil dwelling organisms such as invertebrates and nutrient cycling organisms such as bacteria and fungi are similarly impacted. Consequently, contaminated areas present a direct toxicity risk to plants and other soil biota and indirect risks to other biota such as birds and small mammals by reducing available habitat and food. This risk is not clearly addressed in the SWES, and may bias low current risk estimates.

The SWES goes on to discuss the uncertainties associated with this analysis, and includes a discussion of the classic risk management question: "So what?" More specifically, it postulates that because the habitat impacted is so common, and so small, does it really matter that it's contaminated? Will the vegetation degradation really adversely affect wildlife populations when there are so many suitable habitats nearby? This and other similar questions are important, but in our opinion are not appropriate for a risk assessment document. Nonetheless, because they are raised, they will be addressed in more detail in subsequent sections.

The SWES goes into great detail establishing the relationship between soil copper and pH and the effects on plant toxicity. Based on the relationship between pCu and reductions in vegetation community structure, a *de minimus* effects level (DEL) and a probable effects pCu concentration (PEL) was proposed. *The DEL is pCu 7, and the PEL is pCu 5.* In the discussion, the DEL and PEL are discussed as they relate to an assessment of vegetation community structure. For example, the DEL is discussed as an indicator of the threshold for maintaining a "pristine" vegetation community, whereas the PEL is considered a threshold for maintaining a functional ecosystem. While this distinction is not necessarily incorrect under all circumstances, it is only one way of interpreting the significance of an exceedence of a DEL or PEL to ecosystem function. A DEL or a PEL based on pCu is a simplified estimate of the effects of a contaminant on an ecosystem and may not account for the myriad of uncertainty associated with the impacts of smelter emissions on soil micro-organisms, highly sensitive species, and synergistic interactions among contaminants. In other words, given the uncertainty in quantifying impacts to an ecosystem, a DEL may be the most appropriate value for maintaining an ecosystem in a functional condition, rather than a PEL.

Sauvé et al. (1998) discusses the relationship between soil total copper and pH in great detail and concludes that a pCu threshold for a 50% inhibition of agricultural plant growth is pCu 6.8 (a PEL). In marked contrast, the Chino SWES PEL based on combined agricultural and plant cover/density data is pCu 5. However, Sauvé et al. (1998) goes further, and estimates the toxicological effects to soil microorganisms (which the Chino SWES did not) and concludes that the PEL would be pCu 8.2. For soil nematodes (which the Chino SWES also did not evaluate) the PEL would be pCu 5.3. Sauvé et al. (1998) combines data for plants and soil organisms, plots, and analyzes them yielding a final PEL causing 50% functional inhibition of pCu 7.7 (pCu 9.6 at 25% inhibition). Overall, the Sauvé et al. (1998) PEL is far more stringent than the value calculated in the Chino SWES. Even if the Sauvé et al. (1998) plant PEL of pCu 6.8 is discounted because it might not reflect the unique sensitivities of plants in and around the Chino area, the soil organism PEL of pCu 8.2 should be considered as without healthy soil biota, the entire ecosystem is impaired. *Considering the combined effects to vegetation and soil dwelling* *organisms, the Chino SWES and* Sauvé et al. (1998), *a reasonable soil remedial goal is likely in the range of pCu ≥ 7, with a total Cu concentration <250 mg/kg and a soil pH of 6.5.*

In conclusion, the weight of evidence presented in the SWES suggests significant and widespread impacts to vegetation and soil organisms.

Wildlife Risk Analysis (SWES Section 3)

Numerous areas within the AOC boundaries present a risk to wildlife, largely due to the effects of cadmium, copper, lead, zinc, and acid. This risk is apparent upon close inspection of site data, but is downplayed in the text of the SWES. The purpose of the following examples is to add some balance to the discussion of uncertainty, in which the potential for underestimating risk is adequately considered.

Determining the magnitude and extent of this risk to wildlife is complex and small variations in ecorisk calculations result in large differences in the final outputs. For small birds, here are two examples:

1) Dose Determination- Food Metal Concentration: The SWES collected soil, insects, and seeds from each ecorisk sample location to determine dose directly. The assumption was that the seeds and insects collected represented the typical metal concentrations in all seeds and insects within the area. In TM-1 (Schafer 1999), seed collection was focused on "herbaceous species and mesquite pods" with a target weight of 5 grams. Because mesquite is the largest and heaviest, metal concentrations measured in "seeds' could be biased towards mesquite. Mesquite is not a seed type consumed by a small ground-feeding bird, and therefore metal ingestion rates for small seed eating birds may be biased low or high, depending on mesquite seed copper accumulation dynamics. Because mesquite is a woody species with deep roots, it will most likely accumulate lower metal concentrations than most herbaceous species.

   The ratio of copper in the seed to that in corresponding soil samples (the bioaccumulation factor) was, on average, 0.03. This is 7 times less than the 0.2 BAF derived from literature values for whole plants reported in the screening ecorisk (TM-1, Schafer 1999). This could mean several things. It may reflect the simple fact that seeds accumulate lower concentrations of metals than entire plants, or that site specific bioavailability of soil metals to plants is lower at this site. Alternatively, it could also mean that the seed sample collected at this site (possibly dominated by mesquite) may not be reflective of typical seed metal content. If this is correct, then the dose, and subsequent HQ for small seed-eating birds, will be biased low. This is just one example of an uncertainty that could result in the SWES *underestimating risk*.

2) Dose Determination- Receptor Type: The SWES focuses on a dark-eyed junco, which is largely a seed eating bird. However, this species is meant to represent the entire spectrum of small birds that could feed in the area. Several insectivorous birds also use

this area, and will feed partially or entirely on insects. Although the data tables present calculations for an insectivorous small bird, results of these calculations are not discussed in any detail; rather the focus is on the seed eating dark eyed junco. In many cases, insect metal concentrations are greater than seed concentrations, resulting in a greater dose and higher HQ than largely discussed in the SWES. (Note: as discussed in (1) above, the SWES BAF for soil-insects is 0.1, whereas the BAF in TM-1 was 0.3. This again suggests that site measurements of insect metal concentrations could possibly be biased low and result in an additional underestimation of HQs).

We would appreciate more detailed discussion on various specific statements. For example, on page 3-22 in the SWES under the detailed analysis of risk from copper the following statement is made: *"The site-wide HQ (LOAEL TRV) for small birds was 3.5, indicating a small potential for risk when using high end (95th percentile) concentrations in prey tissues, soils, and surface water."* First, it is unclear what data and ecorisk inputs were used to determine this value. But assuming this value is reasonably accurate, the statement that a LOAEL-based HQ of 3.5 is "a small potential for risk" is highly subjective. Moreover, only 25 or so samples from such a large area is not sufficient to assign risk to the entire AOC area investigated as part of the SWES.

Another example can be found on page 3-31, in the discussion of small mammal histopathology. *"The percentage of animals lacking any hepatic lesions tended to be higher for the reference area than for onsite animals."* This statement seems to cloud the fact that small mammals on site had more lesions. Similarly, a higher incidence of nephritis was identified in site animals (0% at reference versus 20% at the site). The discussion continues and points out that these differences are not statistically significant, but in the same paragraph acknowledges that the statistical tests are equivocal due to a low sample size for the reference site (9 animals at reference versus 42 in the study area). Moreover, kidney tissue concentrations are as great as 53.6 mg/kg versus 1.7 mg/kg at the reference sites and the species with the greatest lesions was the kangaroo rat, which happens to have a unique and highly specialized kidney adapted to arid environments. Given the: (1) statistical weakness of this comparison, (2) an identification of 20% nephritis at the site compared to none at the reference, (3) elevated kidney cadmium, and (4) a high prevalence of lesions in a species with a potentially sensitive kidney, *the weight of evidence suggests that small mammals may be adversely affected even though the ecorisk concludes that HQs are all below 1.*

There are other examples in the text where the lengthy discussions obfuscate some of the more basic conclusions readily apparent in a review of the data. *The final statement in the executive summary of this section, "The results suggest a small potential for risk to site-wide populations of birds." is over-simplified and somewhat misleading.*

Population Effects

In several instances statements are made regarding risk potentials of "local" populations of small birds and other wildlife versus "regional" populations. Population data have not been collected for either the local populations or regional ones and therefore this statement is speculative at best. Moreover, if considered at all, this is a risk management decision that should take into account the cumulative risks to birds in the region from contaminant and other threats both locally and within migratory corridors.

Statements are also made regarding use of a No Observed Adverse Effect Level (NOAEL) to predict individual risks and a Lowest Observed Adverse Effect Level (LOAEL) to predict potential population risks. This is a tenuous assumption, as these values are related to a severity of effect and in risk assessment are more related to establishing a range of acceptable uncertainty in predictions of risk, not necessarily predictions of risks at various levels of community structure. Potential effects on a population level are best related to a number of factors, including but not limited to, spatial extent of contamination, magnitude of contamination, habitat types and species affected and their life history dynamics (e.g., life span, reproduction dynamics), and the overall baseline status of a population in a particular area. This last point is especially important as it emphasizes the relationship between a site specific population and its overall status on a broader geographic scale. Populations that are already diminished at a population level are potentially more susceptible to catastrophic population crashes than populations that are generally stable. Therefore, any conclusions regarding localized effects on populations must account for broad scale population status of that species. No such studies or analyses have been conducted for this site nor have there been any studies to evaluate local or even regional populations of wildlife in and around the Chino AOC area.

For example, risks to terrestrial wildlife due to cadmium, lead, and zinc are reported primarily near the Groundhog mine. The SWES concludes that there is no significant risk to wildlife populations because this area is so small. While that may be true, it is not supported by any data. Population data have not been collected for either the local populations or regional ones, therefore this statement is somewhat speculative.

Amphibian & Aquatics Risk Analysis (SWES Section 4)

Numerous areas within the AOC boundaries contain ephemeral or perennial water bodies presenting a risk to aquatic biota. The first sentence in the executive summary "A small potential for risks to aquatic receptors is predicted in the ephemeral drainages along the Hanover and Whitewater Creek corridor." is not at all consistent with the data. This entire section is largely a risk management discussion rather than a risk assessment and is contrary to scientific literature documenting the importance of ephemeral habitats to aquatic and semi-aquatic biota and other wildlife feeding in these habitats. We believe that many statements in this section do not truly represent issues associated with baseline conditions and background metal concentrations.

For instance, the implication made is that species may be adapted to elevated metal concentrations and are therefore at a lower risk. In fact, organisms that acclimate or adapt to one stressor, such as metals, often do so with an increased energetic demand, resulting in increased susceptibility to other more random physiological challenges such as disease or climate fluctuations.

Another example is the conclusion that the water quality criteria (WQC) used to evaluate risk are only applicable to "cold-water trout fisheries." While it is true that trout are a metal sensitive species, they are not the most sensitive. Trout are also sometimes regarded as a "placeholder" for other more toxic invertebrate species that have not yet been tested with a level of scientific rigor to warrant their formal inclusion in revised WQC standards. Thus, even though the WQC are calculated using a variety of species, including trout, they are not considered "fishery specific" standards. In fact, the New Mexico Environment Department, through the New Mexico Water Quality Control Commission, now applies acute fishery WQSs to ephemeral streams in New Mexico.

Furthermore, risks to amphibians from copper are significant. The Chiricahua leopard frog (*Rana chiricahuensis*) is now a federally listed species, and populations are critically low in New Mexico. Even minor additional threats from metals may be the proverbial "straw that broke the camels back" for this species. Any ephemeral or perennial waters potentially suitable for the Chiricahua leopard frog must be protected and risk assessments and remedial decisions must focus on individual animals.

Overall, the risk to aquatic and semi-aquatic organisms is significant based on the data in the SWES and current and historical sampling of water and sediments (not directly considered in the SWES). Any soils within the channel (both shallow and deep) and adjacent bank/terrace soils with elevated metal concentrations are likely a current and/or potential future risk (and contaminant source) to aquatic and semi-aquatic biota.

<u>Risk Characterization (SWES Section 5)</u>

The initial discussion relating LOAEL HQ exceedences to severity of ecological effects is debatable. The HQs are placed in categories, each representing different levels of overall risk. For HQ's from 1 to 10, risk is considered as "small potential for adverse effects." We do not concur with this simplification. Moreover, given that most LOAEL HQs at the site are less than 10, the implication becomes that risk is minimal, so why remediate?

Next, in the discussion of vegetation risks, the concept of acclimation and adaptation is raised as a means to downplay the laboratory toxicity measured in "naïve" alfalfa and ryegrass. As mentioned above in the discussion of aquatic organism risks, adaptation and acclimation are often adverse effects in themselves, and therefore should not be invoked to discount toxicity due to metals. The "toxicity" in this case is a potential reduction in a plants growth, reproduction, or resistance to disease at the expense of an increased resistance to direct toxicity of even higher soil metal concentrations.

In Section 5.1.3 "Stressor Response Analysis" the SWES concludes that *"Conclusive proof of the effect of depressed pH and elevated metals concentrations would require additional study. Such studies would be recommended if needed to make risk-management (i.e., remediation) decisions, or to support claims of cause/effects claims related to legal liability."* While grazing, soil types, climate etc., all play a role in vegetation community dynamics at this site, the existing weight of evidence strongly supports a conclusion that smelter and tailings releases are the primary cause of the observed vegetation effects. The legal standard applicable here is one of "preponderance of evidence," not the more stringent "beyond a reasonable doubt" standard applicable in criminal matters. We do not feel that additional studies are needed to make reasonable and legally defendable remedial decisions.

Specific Comments on SWES-STIU

Unlike the SWES, which collected samples from 0-6" sieved to 2000µm, the SWES-STIU assessed ecorisk using both "surface" soil (0-1" sieved to 200µm) and "shallow" soils (0-6" sieved to 2000µm). However, all quantitative calculations were based on shallow 0-6" samples. In general, the SWES-STIU does not change any conclusions regarding ecorisk for plants or terrestrial wildlife made in the SWES. Samples collected for the SWES-STIU do expand the area impacted, but risks are in accordance with those in the SWES.

Despite the additional sampling conducted for the SWES-STIU, the northernmost extent of contamination has yet to be established (e.g., see SWES-STIU Figures 2.2-2 and 3.2-2). Decreased soil pCu and risk to small ground feeding birds extends to the northernmost samples. Similarly, the elevated copper concentration in Rustler Canyon sediment sample SED09 suggests that there may be an additional source in upper Rustler Canyon or perhaps smelter impacts. Additional samples should be collected in these areas to determine the full extent of contamination. This is of particular concern to the Service, as these areas are known to contain suitable habitat and small populations of Chiricahua leopard frogs.

Conclusions

Both the SWES and the SWES-STIU are highly informative, data-rich documents based on a solid sampling and analysis plan. However, as is often the case when large amounts of data are collected, the interpretation of these data is very complex. Both these documents present a technically correct and reasonable interpretation of these data, but one that seems biased towards downplaying the extent and magnitude of the risks. There are a multitude of instances where a different and equally valid calculation, assumption, or interpretation could result in a different view of the potential risks. Nonetheless, no matter the interpretation, the base soil copper and pH data paint a fairly unequivocal picture of the distribution of contamination in the area and its link to smelter and tailings sources. Clearly, a portion of these contaminated areas require remediation via removal, soil, amendments or other efforts. The most efficient way to resolve differences in scientific opinion on the interpretation of the risk data and to formulate a reasonable site remedial approach may be to hold one or more face to face meetings to discuss the issues.

Again, thank you for the opportunity to provide comments on these documents, and if you have further questions please contact Russ MacRae at (505) 761-4724, or by email at russ_macrae@fws.gov.

Sincerely,

Wally Murphy
Field Supervisor

cc:
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